REMARKS

Claims 1-28, all the claims pending in the application, stand rejected on prior art grounds. Applicants respectfully traverse these rejections based on the following discussion. Claims 2, 8 and 22 are canceled herein and the previously claimed features of claims 2, 8 and 22 have been amended into independent claims 1, 7 and 21, respectively.

I. The Prior Art Rejections

Claims 1, 3, 7, 10, 13, 21, 24, and 27 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Cowell, et al. (U.S. Patent No. 5,268,068), hereinafter referred to as Cowell, in view of IBM TDB NN62096. Claims 2, 4-6, 11-12, 14-20, 25-26, and 28 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Cowell, in view of IBM TDB NN62096, and in further view of Berasi, et al. (U.S. Publication No. 2004/0238491), hereinafter referred to as Berasi et al. 2004. Claims 8-9, and 22-23 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Cowell, in view of IBM TDB NN62096, in further view of IBM TDB NN7707577. Applicants respectfully traverse these rejections based on the following discussion.

A. Rejections Based on Berasi et al. 2004.

The Office Action rejects claims 2, 4-6, 11, 12, 14-20, 25, 26 and 28 under 35 U.S.C. §103(a) based on Berasi et al. 2004 in combination with Cowell and IBM TDB NN62096. Specifically, the Office Action cites Berasi et al. 2004 as teaching the following claimed features: (1) knife-edge of approximately 0.2 mils; and (2) controlling pH, total Fe concentration, and Oxidation/Reduction Potential. However, the Applicants

submit that Berasi et al. 2004 is not available prior art under 35 U.S.C. §102, and thus, is not available prior art under 35 U.S.C. §103(a) (see MPEP 2141.01). Specifically, "before answering Graham's 'content' inquiry, it must be known whether a patent or publication is in the prior art under 35 U.S.C. 102" Panduit Corp. v. Dennison Mfg. Co., 810 F.2d 1561, 1568, 1 USPQ2d 1593, 1597 (Fed. Cir.), cert. denied, 481 U.S. 1052 (1987).

Berasi et al. 2004 refers to a patent application for an invention with the same exact co-inventors as the present application. Berasi et al. 2004 was filed on May 30, 2003, approximately one month before the July 1, 2003, filing date of the present invention. Berasi et al. 2004 was not published until December 2, 2005. Berasi et al. 2004 does not qualify as prior art under §102(a) because it was not published before the invention by the applicants of the present application. It does not qualify as prior art under §102(b) because it was not published more than one year prior to the filing of the present application. It does not qualify under §102(e) as it was not filed by another, nor was it published before the invention by the applicants of the present application. Berasi, similarly, does not qualify as prior art under any of the other sections of §102. and, consequently, is not available to be cited as prior art under §103(a) against the present application.

Independent claims 1, 7, 15 and 21 have each been amended and reflect the feature that the etching process produces a via with a knife-edge of approximately 0.2 mils. As indicated by the Office Action, this feature is not taught by Cowell in combination with TDB NN62096 and/or IBM TDB NN7707577. Therefore, amended

independent claims 1, 7, 15 and 21 are patentable of the cited prior art references. Furthermore, dependent claims 3-6, 9-14, 16-20, and 23-28 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

B. Rejections of Independent Claims 1, 7, 15 and 21 Based on Cowell in combination with IBM TDB NN62096 and/or IBM TDB NN7707577.

Col. 3, lines 25-41 of Cowell, as well as Figures 1A and 1B, illustrate a method of forming a metal mask 110 having patterned vias that will subsequently be used to form solder bumps. Resist layers 140 patterned with symmetric 3.5 mil openings are formed on both sides of the metal layer 110. Increasing etch times are used to progressively under cut the photoresist layer 140 at the openings, using an isotropic wet etch. The disclosed metal thickness is 3 mils. The method forms a via with a diameter of 5.6 mils. The parameters used for the etching process (e.g., the timing, pH, etc.) of Cowell were not disclosed, nor was the thickness of the photoresist.

The Cowell method, as disclosed, is suitable for purpose for which it was designed, specifically, for forming a via in a relatively thin 3 mil metal mask layer for use in forming conventional solder balls. However, the Applicants have determined that it would be advantages over prior art, such as Cowell, to form a mask that is capable of increasing the bump volume (e.g., up to three times larger) by increasing the thickness of

the mylobdenum mask and by increasing the diameter of the vias within the mask (i.e., increasing the geometries) (see paragraph [0035]). They also determined that when using thicker molybdenum foil sheets and trying to define vias with larger diameters (see paragraphs [0004]), reliable image formation is difficult to achieve using conventional techniques. Additionally, the Applicants found that decreasing the stress on the unsupported edges of the photoresist layer during the prolonged etch processes required to etch larger vias in thicker molybdenum sheets, allows the unsupported edge to survive so that image reliability can be achieved (see paragraphs [0008], [0029] and [0036]). Reducing the stress on the photoresist layer can be achieved by increasing the photo-resist thickness, decreasing the spray pressure of the etchant, avoiding unfavorable chemistries, etc. (see paragraphs [0009], [0024] and [0035]). The present invention, thus, modifies the conventional processes (as shown in Figures 1A-1B of Cowell) in order to achieve reliable image formation in thicker molybdenum masks with increased geometries, while simultaneously maintaining knife-edge control (see paragraph [0008]).

More particularly, regarding amended independent claims 1 7, 15, and 21, the Applicants submit that the following features are neither taught, suggested, nor made obvious in light of Cowell and IBM TDB NN62096 and/or IBM TDB NN7707577:

(1) that "said molybdenum foil sheet is approximately 8 mils thick" (see claims 1 and 15) or "approximately 4 mils thick" (see claims 7 and 21);

(2) that "said photoresist layer is approximately 12 microns thick";

(3) that the etching is "for a time period sufficient to produce a via through said molybdenum foil sheet such that said via has a second diameter of

approximately 12 mils and a knife-edge of approximately 0.2 mils" (see claims 1 and 15) or "such that said via has a third diameter of approximately 10 mils adjacent to said first opening, a fourth diameter of approximately 14 mils adjacent to said second opening and a knife-edge of approximately 0.2 mils" (see claims 7 and 21);

(4) "periodically adjusting a chemistry of said etchant spray to avoid a reduction in etchant activity (see claims 15 and 21)"; and

(5) "wherein said depositing of said photoresist that is approximately 12 microns thick and said using of said etchant spray with said pressure of approximately 5 psi ensures that after said time period said unsupported edge survives" (see claims 1 and 7) or "wherein said depositing of said photoresist that is approximately 12 microns thick, said using of said etchant spray with said pressure of approximately 5 psi, and said adjusting of said chemistry ensures that after said time period said unsupported edge survives" (see claims 15 and 21).

The Applicants submit that the Gardner case does not apply because the claims at issue refer to a method and not a device. Specifically, the Applicants are not claiming the structure of a mask that has larger dimensions but performs the same function, but rather a method of forming the device with those larger dimensions (e.g., a mask that is 8 or 4 mils thick vice a 3.5 mil thick mask and a 12 mil diameter via or a 10-14 mil diameter via vice a 5.6 mil diameter). While it might be obvious simply to form the mask with the larger dimensions using the Cowell method, as discussed above, it is precisely those

larger dimensions that create the problem that requires the modification of the Cowell method. Specifically, if the etching of the thicker molybdenum foil is conducted for a time period sufficient to produce a 12 mil diameter via through the foil, stress is placed upon the unsupported edge of the photo-resist layer and a reliable image may not be achieved. However, if a photoresist that is approximately 12 microns thick is used, if an etchant spray with a pressure of approximately 5 psi is also used, and if the chemistry of the etchant is periodically adjusted, then even after the prolonged etch (that is not required in Cowell because of the smaller dimensions), the unsupported edge of the photoresist film will survive without degradation irrespective of the unfavorable geometries required by the DLP bump geometry (see paragraph [0036]).

Therefore, amended independent claims 1, 7, 15 and 21 are patentable over the cited prior art references. Furthermore, dependent claims 3-6, 9-14, 16-20 and 23-38 are similarly patentable, not only by virtue of their dependency from a patentable independent claim, but also by virtue of the additional features of the invention they define. Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

II. Formal Matters and Conclusion

With respect to the rejections to the claims, the claims have been amended, above, to overcome these rejections. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections to the claims.

In view of the foregoing, Applicants submit that claims 1, 3-7, 9-21, and 23-28, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0458.

Respectfully submitted,

Dated: 2/16/06

Pamela M. Riley, Esq.
Registration No. 40,146

Gibb I.P. Law Firm, LLC
2568-A Riva Road, Suite 304
Annapolis, MD 21401
Voice: (410) 573-6501
Fax: (301) 261-8825
Customer Number: 29154